(12) UK Patent Application (19) GB (11) 2 344 863 (13) A

(43) Date of A Publication 21.06.2000

(21) Application No 9827776.7

(22) Date of Filing 18.12.1998

(51) INT CL[7]
F16L 37/58 // A47L 9/00

(52) UK CL (Edition R)
F2G G36 G4A G4A6 G4C G4F G4Z G99
U1S S1233

(56) Documents Cited
GB 2115509 A GB 0425783 A

(58) Field of Search
UK CL (Edition Q) F2G G4A G4B1 G4B2 G4C G4F G4Z
INT CL[6] A47L 9/00 , F16L 37/00 37/08 37/084 37/12 37/133 37/26 37/50 37/58

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(54) Abstract Title
Connector for conduits

(57) The connector comprises a first part (12) and a second part (59) releasable from the first part (12), both having conduits for mutual communication with a seal (33) arranged between them characterised in that a movable arm (90) is mounted on the first part (12) and carrying a portion (32) defining the respective conduit, and biasing means (95), e.g a compression spring biasing the portion (32) towards the second part (59). Preferably, the direction in which the second part (52) is releasable from the first part (12) is substantially perpendicular to the direction of movement of the portion (32) of the first part (12) so that the second part (59) can be released from the first part (12) without placing undue stress on the seal, (33). A latch (96) retains the parts together and has an inclined face for moving the portion (32) against spring bias when the second part (59) is re-introduced. The first part is a chassis or housing of a robotic vacuum cleaner, the second part being an inlet to dirt/dust separating cyclone apparatus.

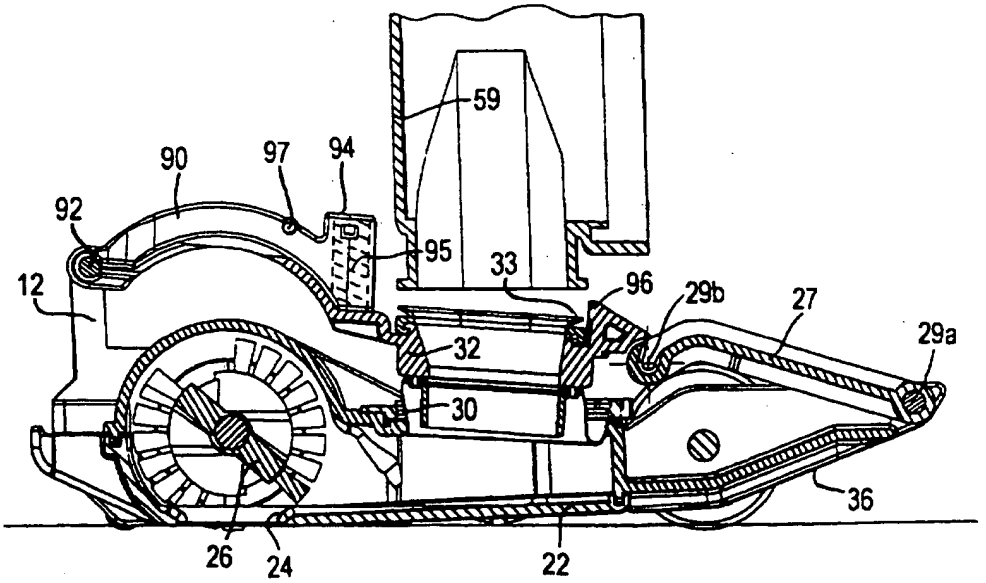

FIG.5b.

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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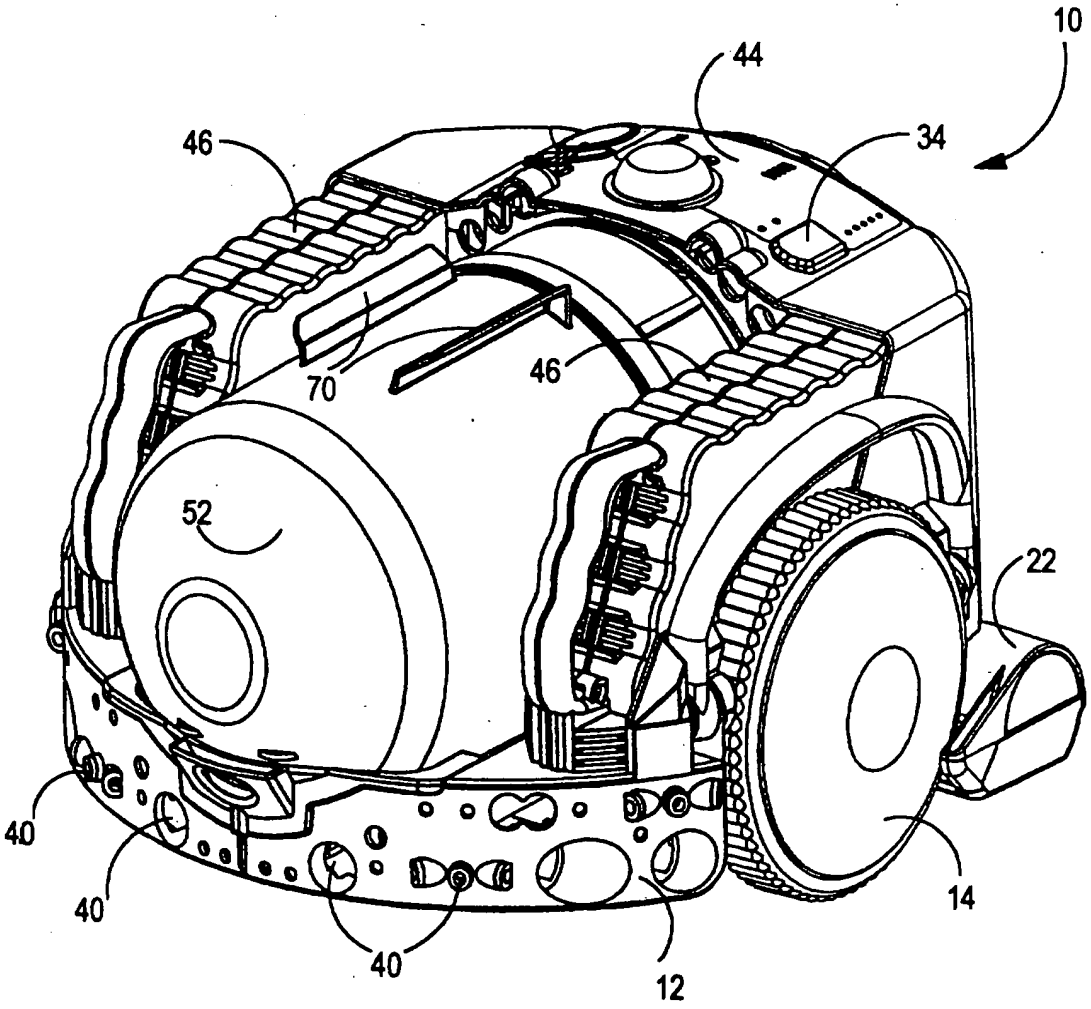

FIG.1.

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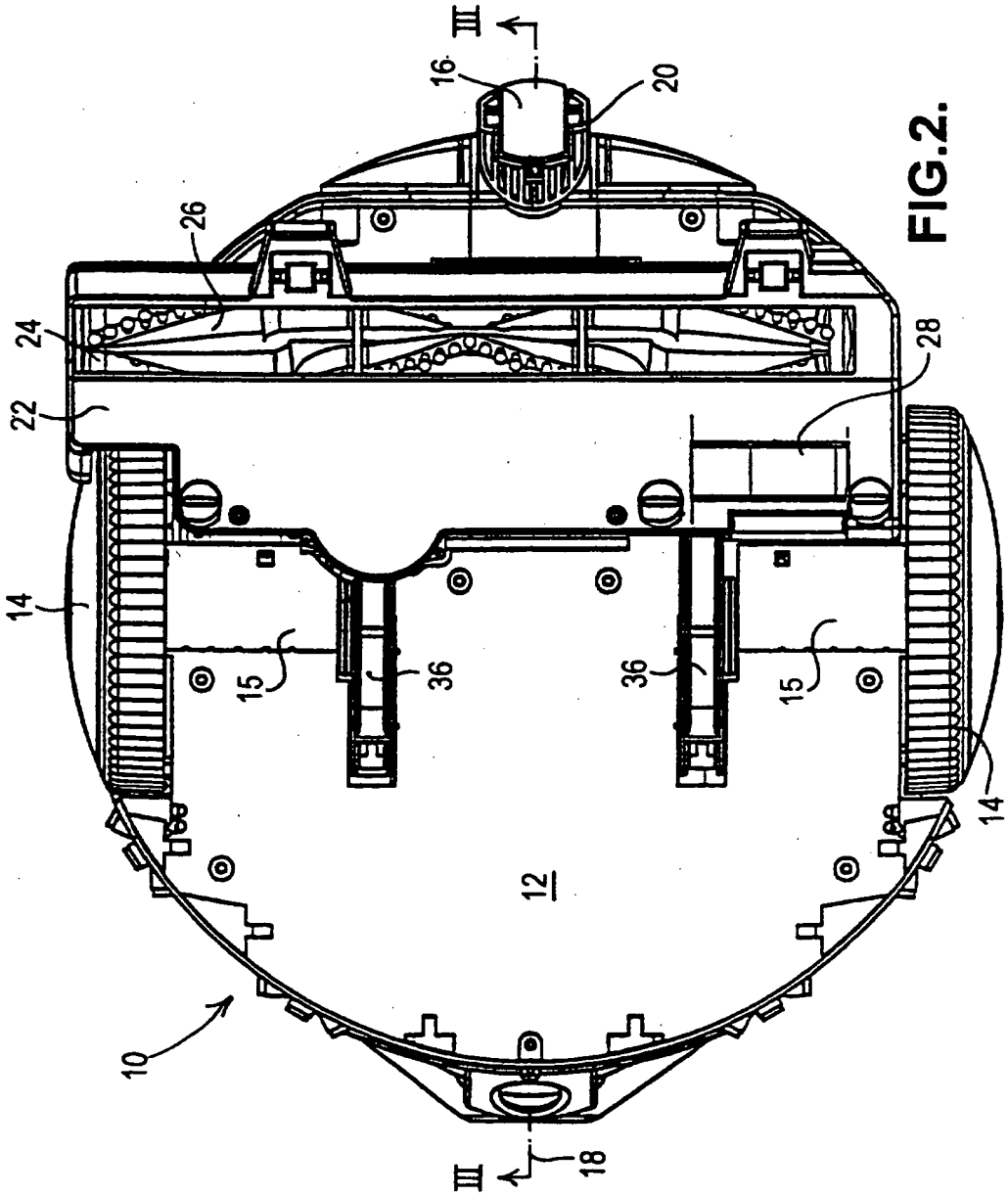

FIG.2.

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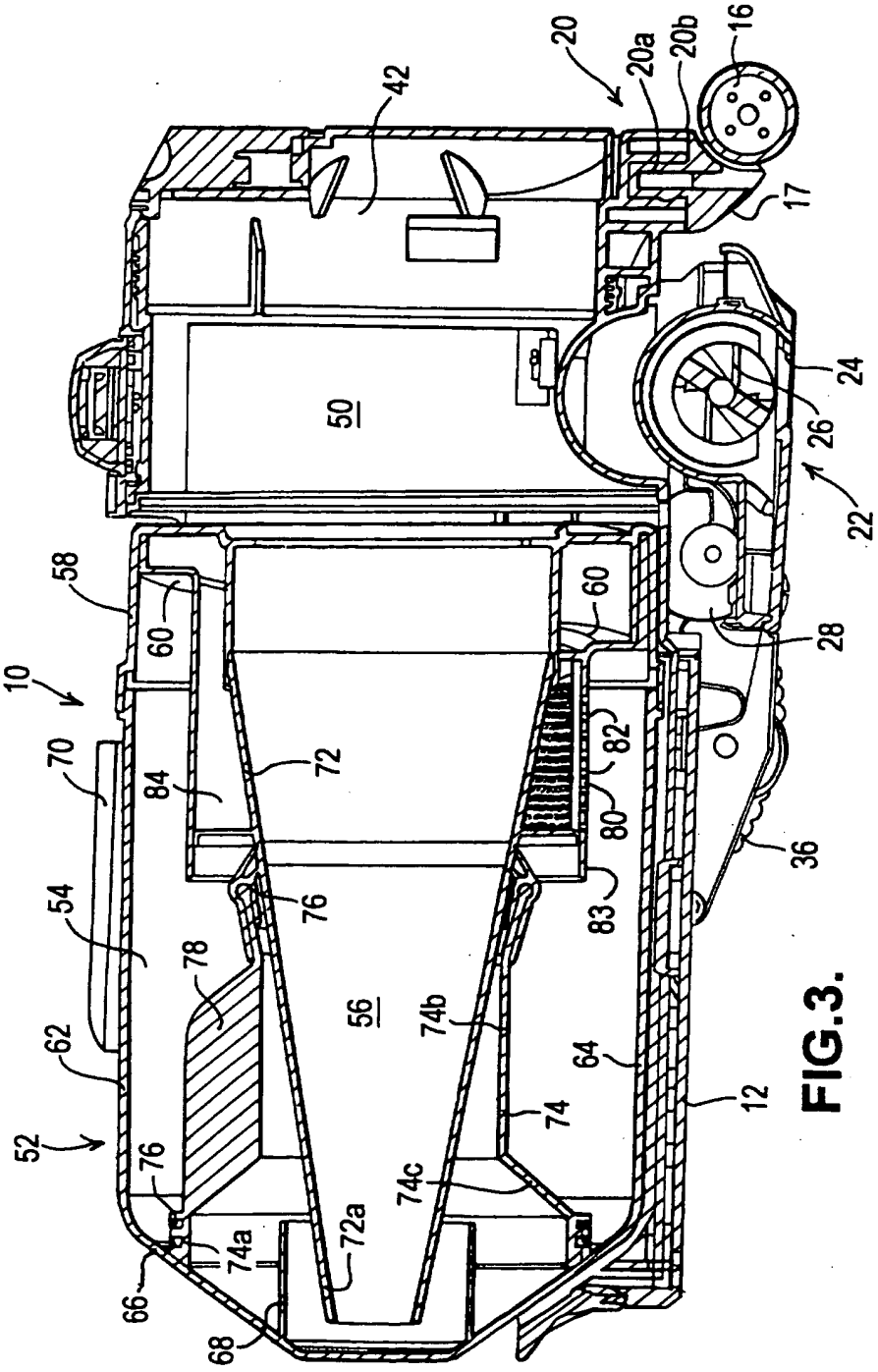
20
20a
20b
16
42
17
24
26
22
50
58
60
60
28
10
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84
72
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80
36
54
76
83
78
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64
12
52
74
76
74c
72a
74a
66
68

FIG.3.

FIG.4a.

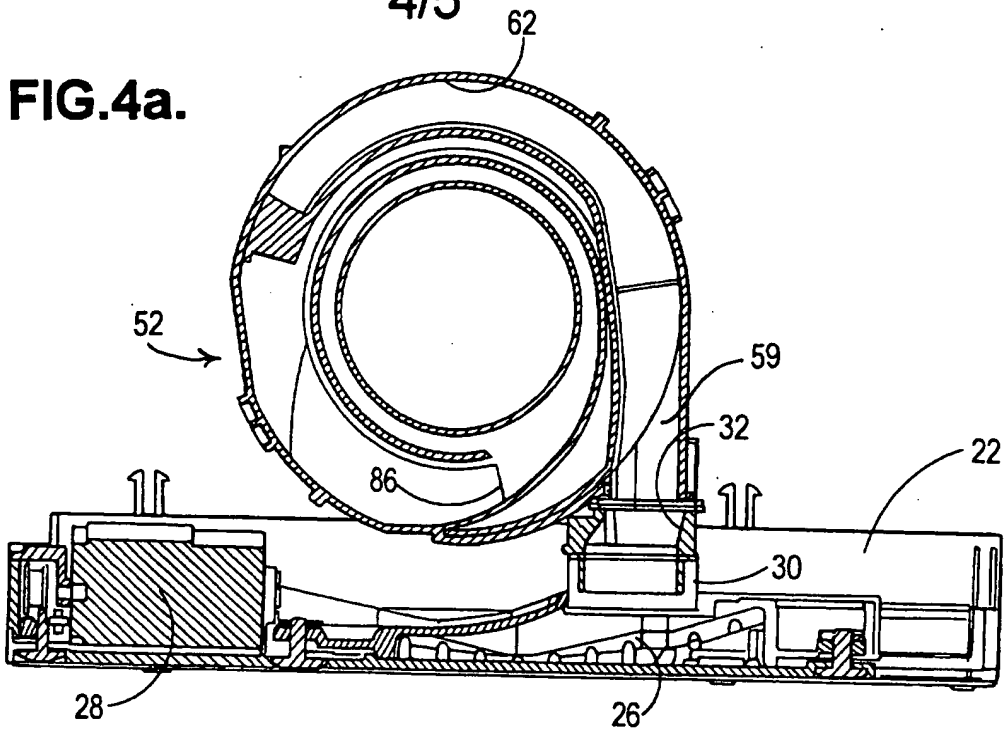
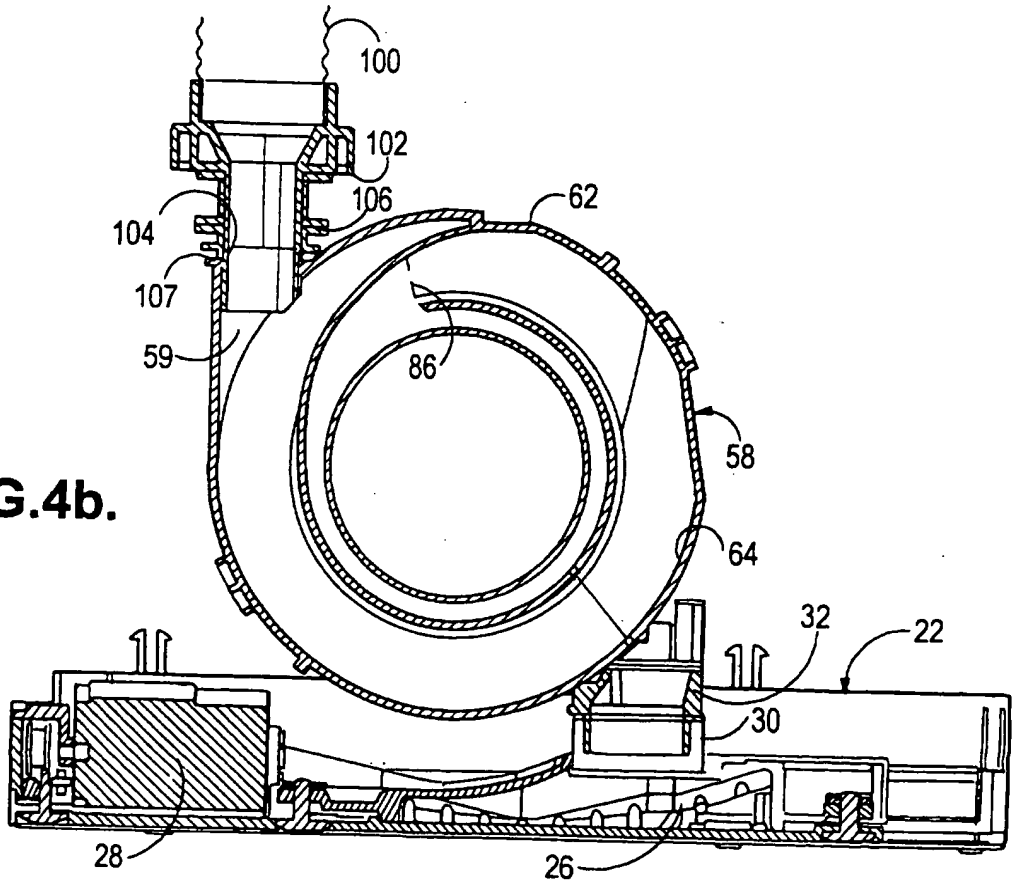

62
52
59
32
22
86
30
28
26

FIG.4b.


100
102
106
62
104
107
59
86
58
64
32
22
30
28
26

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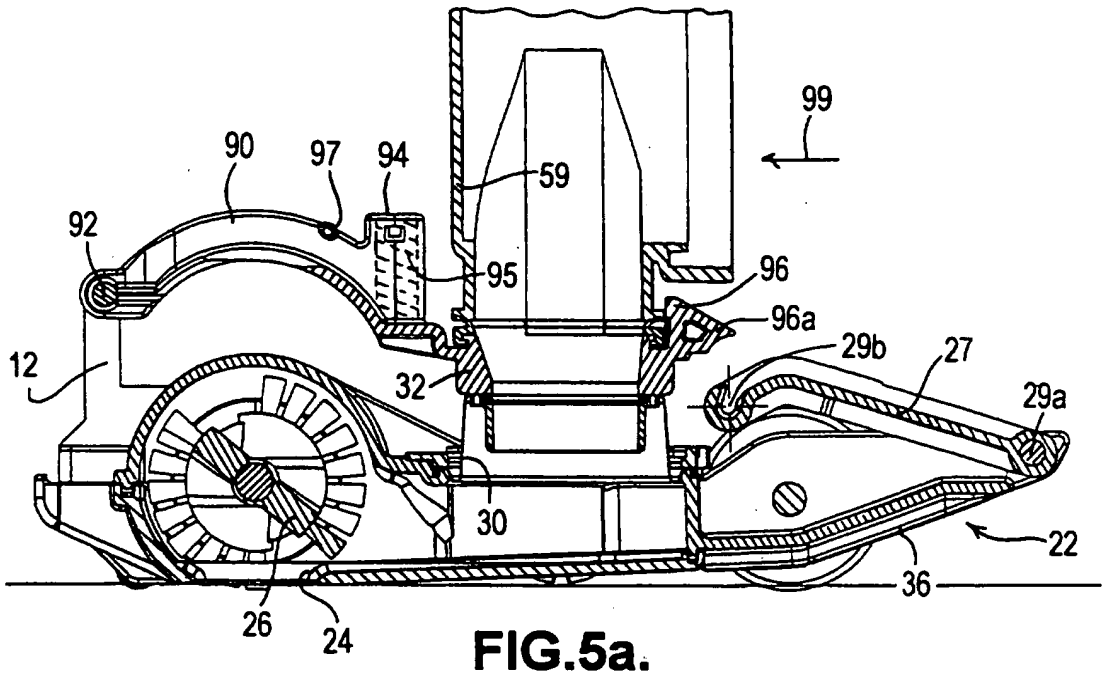

FIG.5a.

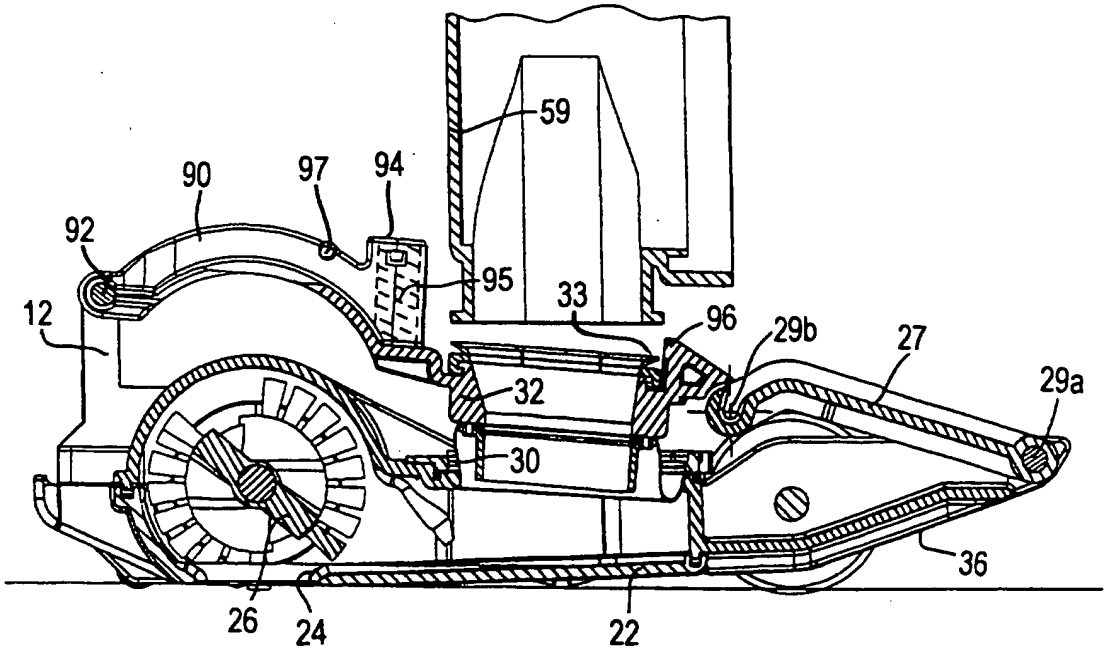

FIG.5b.

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A Connector

The invention relates to a connector for forming a connection between a first part and a second part releasable from the first part, the first and second parts having conduits arranged therein, which conduits are arranged to communicate with one another when the first part is connected to the second part, and having a seal arranged between the first and second parts. Particularly, but not exclusively, the invention relates to a connector for use in a vacuum cleaner and to a vacuum cleaner incorporating such a connector.

Seals usually operate best when the parts between which they are arranged are pressed together so that the seal is compressed. When the parts to be connected, and between which the seal is to be effected, are released and connected in a direction which allows the seal to be compressed, the seal is effective. However, many parts which are desirably connected and sealed together are necessarily brought together in a sliding manner so that the seal is forced to move laterally across a surface before being brought into its operative position. Such a movement is detrimental to the seal and can cause distortion or cockling if pressure is applied in a direction which is transverse or perpendicular to the direction of motion.

It is an object of the invention to provide a connector which is capable of frequent operation so as to connect and release the two parts quickly and easily and without any special skill being required. It is a further object of the invention to provide such a connector which, when it is operated, little or no wear is applied to the face-loaded seal so that the life thereof is prolonged. It is a further object of the invention to provide a connector of the type mentioned at the outset which is suitable for use in a vacuum cleaner in order to connect the dirt and dust separating apparatus to the chassis or housing thereof. It is a still further object of the invention to provide a connector in which a sealing function is applied simultaneously with a catch function.

The invention provides a connector for forming a connection between a first part and a second part releasable from the first part, the first and second parts having conduits arranged therein, which conduits are arranged to communicate with one another when the first part is connected to the second part, and having a seal arranged between the first and second parts, characterised in that the connector comprises a movable arm mounted on the first part and carrying a portion of the first part defining the respective conduit, and biasing means biasing the said portion of the first part towards the second part. Preferably, the direction in which the second part is releasable from the first part is substantially perpendicular to the direction of movement of the said portion of the first part. This type of arrangement allows the seal, normally compressed between the two parts, to be moved away from one of the parts so that the second part can be released from the first part without the seal being deformed or placed under stress by the movement of the second part relative to the first part. This releasing of the second part from the first part whilst the seal is not under stress reduces the amount of wear to which the seal is subjected, reduces the risk of cockling and thus prolongs the useful life of the seal.

Further preferred features of the invention are set out in the subsidiary claims.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, wherein:
Figure 1 is a perspective view of a vacuum cleaner according to the invention;
Figure 2 is an underneath view of the vacuum cleaner of Figure 1;
Figure 3 is a sectional view through the vacuum cleaner of Figure 1 taken along the line III-III of Figure 2;
Figure 4a is a transverse sectional view through part of the cleaner of Figure 1 showing the separating apparatus in a first position;
Figure 4b is a transverse sectional view through part of the cleaner of Figure 1 showing the separating apparatus in a second position;
Figure 5a is a longitudinal sectional view through part of the cleaner of Figure 1 showing the separating apparatus connected to the chassis; and

Figure 5b is a longitudinal sectional view through part of the cleaner of Figure 1 showing the separating apparatus being released from the chassis.

The vacuum cleaner 10 shown in the drawings has a supporting chassis 12 which is generally circular in shape and is supported on two driven wheels 14 and a castor wheel 16. The chassis 12 is preferably manufactured from high-strength moulded plastics material, such as ABS, but can equally be made from metal such as aluminium or steel. The chassis 12 provides support for the components of the cleaner 10 which will be described below. The driven wheels 14 are arranged at either end of a diameter of the chassis 12, the diameter lying perpendicular to the longitudinal axis 18 of the cleaner 10. Each driven wheel 14 is moulded from a high-strength plastics material and carries a comparatively soft, ridged band around its circumference to enhance the grip of the wheel 14 when the cleaner 10 is traversing a smooth floor. The driven wheels 14 are mounted independently of one another via support bearings (not shown) and each driven wheel 14 is connected directly to a motor 15 which is capable of driving the respective wheel 14 in either a forward direction or a reverse direction. By driving both wheels 14 forward at the same speed, the cleaner 10 can be driven in a forward direction. By driving both wheels 14 in a reverse direction at the same speed, the cleaner 10 can be driven in a backward direction. By driving the wheels 14 in opposite directions, the cleaner 10 can be made to rotate about its own central axis so as to effect a turning manoeuvre. The aforementioned method of driving a vehicle is well known and will not therefore be described any further here.

The castor wheel 16 is significantly smaller in diameter than the driven wheels 14 as can be seen from, for example, Figure 3. The castor wheel 16 is not driven and merely serves to support the chassis 12 at the rear of the cleaner 10. The location of the castor wheel 16 at the trailing edge of the chassis 12, and the fact that the castor wheel 16 is swivellingly mounted on the chassis by means of a swivel joint 20, allows the castor wheel 16 to trail behind the cleaner 10 in a manner which does not hinder the manoeuvrability of the cleaner 10 whilst it is being driven by way of the driven wheels 14. The swivel joint 20 is most clearly shown in Figure 3. The castor wheel 16 is

fixedly attached to an upwardly extending cylindrical member 20a which is received by an annular housing 20b to allow free rotational movement of the cylindrical member 20a therewithin. This type of arrangement is well known. The castor wheel 16 can be made from a moulded plastics material or can be formed from another synthetic material such as Nylon.

Mounted on the underside of the chassis 12 is a cleaner head 22 which includes a suction opening 24 facing the surface on which the cleaner 10 is supported. The suction opening 24 is essentially rectangular and extends across the majority of the width of the cleaner head 22. A brush bar 26 is rotatably mounted in the suction opening 24 and a motor 28 is mounted on the cleaner head 22 for driving the brush bar 26 by way of a drive belt (not shown) extending between a shaft of the motor 28 and the brush bar 26. The cleaner head 22 is mounted on the chassis 12 in such a way that the cleaner head 22 is able to float on the surface to be cleaned. This is achieved in this embodiment in that the cleaner head 22 is pivotally connected to an arm 27 about a first pivot 29a (see Figure 5) which in turn is pivotally connected to the underside of the chassis 12 about a second pivot 29b (chassis 12 is not shown in Figure 5 for the sake of clarity). The double articulation of the connection between the cleaner head 22 and the chassis 12 allows the cleaner head 22 to move freely in a vertical direction with respect to the chassis 12. This enables the cleaner head 22 to climb over small obstacles such as books, magazines, rug edges, etc. Obstacles of up to approximately 25mm in height can be traversed in this way. A flexible connection 30 (see Figures 4 and 5) is located between a rear portion of the cleaner head 22 and an inlet port 32 located in the chassis 12. The flexible connection 30 consists of a rolling seal, one end of which is sealingly attached to the upstream mouth of the inlet port 32 and the other end of which is sealingly attached to the periphery of an aperture in the cleaner head 22. When the cleaner head 22 moves upwardly with respect to the chassis 12, the rolling seal 30 distorts or crumples to accommodate the upward movement of the cleaner head 22. When the cleaner head 22 moves downwardly with respect to the chassis 12, the rolling seal 30 unfolds or extends into an extended position to accommodate the downward movement.

In order to assist the cleaner head 22 to move vertically upwards when an obstacle is encountered, forwardly projecting ramps 36 are provided at the front edge of the cleaner head 22. In the event that an obstacle is encountered, the obstacle will initially abut against the ramps 36 and the inclination of the ramps will then lift the cleaner head 22 over the obstacle in question so as to avoid the cleaner 10 from becoming lodged against the obstacle. The cleaner head 22 is shown in a lowered position in Figures 3 and 5. The castor wheel 16 also includes a ramped portion 17 which provides additional assistance when the cleaner 10 encounters an obstacle and is required to climb over it. In this way, the castor wheel 16 will not become lodged against the obstacle after the cleaner head 22 has climbed over it.

As can be seen from Figure 2, the cleaner head 22 is asymmetrically mounted on the chassis 12 so that one side of the cleaner head 22 protrudes beyond the general circumference of the chassis 12. This allows the cleaner 10 to clean up to the edge of a room on the side of the cleaner 10 on which the cleaner head 22 protrudes.

The chassis 12 carries a plurality of sensors 40 which are designed and arranged to detect obstacles in the path of the cleaner 10 and its proximity to, for example, a wall or other boundary such as a piece of furniture. The sensors 40 comprise several ultra-sonic sensors and several infra-red sensors. The array illustrated in Figure 1 is not intended to be limitative and the arrangement of the sensors does not form part of the present invention. Suffice it to say that the vacuum cleaner 10 carries sufficient sensors and detectors 40 to enable the cleaner 10 to guide itself or to be guided around a predefined area so that the said area can be cleaned. Control software, comprising navigation controls and steering devices, is housed within a housing 42 located beneath a control panel 44 or elsewhere within the cleaner 10. Battery packs 46 are mounted on the chassis 12 inwardly of the driven wheels 14 to provide power to the motors for driving the wheels 14 and to the control software. The battery packs 46 are removable to allow them to be transferred to a battery charger (not shown). The vacuum cleaner 10 also

includes a motor and fan unit 50 supported on the chassis 12 for drawing dirty air into the vacuum cleaner 10 via the suction opening 24 in the cleaner head 22.

The chassis 12 also carries a cyclonic separator 52 for separating dirt and dust from the air drawn into the cleaner 10. The features of the cyclonic separator 52 are best seen from Figures 3 and 4. The cyclonic separator 52 comprises an outer cyclone 54 and an inner cyclone 56 arranged concentrically therewith, both cyclones 54, 56 having their coaxial axes lying horizontally. The cyclonic separator 52 comprises an end portion 58 which has a tangential inlet 59. The tangential inlet 59 has a mouth at the distal end thereof. The mouth is generally circular in shape, but is somewhat flattened along one edge to give the mouth a vaguely D-shaped section. The end portion 58 is otherwise generally cylindrical and has an end wall 60 which is generally helical. The end portion 58 opens directly into a cylindrical bin 62 having an outer wall 64 whose diameter is the same as that of the end portion 58. The end portion 58 and the cylindrical bin 62 are held together by joined by way of a releasable clip which can be of any known design. No specific clip is shown in the drawings. A lip seal is provided between the cylindrical bin 62 and the end portion 52 in order to maintain a good seal between the respective parts. The cylindrical bin 62 is made from a transparent plastics material to allow a user to view the interior of the outer cyclone 54. The end of the bin 62 remote from the end portion 58 is frusto-conical in shape and closed. A locating ring 66 is formed integrally with the end of the bin at a distance from the outer wall 64 thereof and a dust ring 68 is also formed integrally with the end of the bin 62 inwardly of the locating ring 66. Located on the outer surface of the bin 62 are two opposed gripper portions 70 which are adapted to assist a user to remove the separator 52 from the chassis 12 for emptying purposes. Specifically, the gripper portions 70 are moulded integrally with the transparent bin 62 and extend upwardly and outwardly from the outer wall 64 so as to form an undercut profile as shown in Figure 1.

The inner cyclone 56 is formed by a partially-cylindrical, partially-frusto-conical cyclone body 72 which is rigidly attached to the end face of the end portion 58. The cyclone body 72 lies along the longitudinal axis of the transparent bin 62 and extends

almost to the end face thereof so that the distal end 72a of the cyclone body 72 is surrounded by the dust ring 68. The gap between the cone opening at the distal end 72a of the cyclone body 72 and the end face of the bin 62 is preferably less than 8mm.

A fine dust collector 74 is located in the bin 62 and is supported by the locating ring 66 at one end thereof. The fine dust collector 74 is supported at the other end thereof by the cyclone body 72. Seals 76 are provided between the fine dust collector 74 and the respective support at either end. The fine dust collector 74 has a first cylindrical portion 74a adapted to be received within the locating ring 66, and a second cylindrical portion 74b having a smaller diameter than the first cylindrical portion 74a. The cylindrical portions 74a, 74b are joined by a frusto-conical portion 74c which is integrally moulded therewith. A single fin or baffle 78 is also moulded integrally with the fine dust collector 74 and extends radially outwardly from the second cylindrical portion 74b and from the frusto-conical portion 74c. The outer edge of the fin 78 is aligned with the first cylindrical portion 74a and the edge of the fin 78 remote from the first cylindrical portion 74a is essentially parallel to the frusto-conical portion 74c. The fin 78 extends vertically upwardly from the fine dust collector 74.

A shroud 80 is located between the first and second cyclones 54, 56. The shroud 80 is cylindrical in shape and is supported at one end by the end portion 58 and by the cyclone body 72 of the inner cyclone 56 at the other end. As is known, the shroud 80 has perforations 82 extending therethrough and a lip 83 projecting from the end of the shroud 80 remote from the end portion 58. A channel 84 is formed between the shroud 80 and the outer surface of the cyclone body 72, which channel 84 communicates with an entry port 86 leading to the interior of the inner cyclone 56 in a manner which encourages the incoming airflow to adopt a swirling, helical path. This is achieved by means of a tangential or scroll entry into the inner cyclone 56 as can be seen from Figure 4. A vortex finder (not shown) is mounted on the housing of the motor and fan unit 50 and extends into the second cyclone 56 through an aperture in the end wall 60 of the end portion 58. The vortex finder is located centrally of the larger end of the inner cyclone 56 to conduct air out of the cyclonic separator 52 after separation has taken

place. It also helps to secure the cyclonic separator 52 in position on the chassis 12. The exiting air is conducted past the motor and fan unit 50 so that the motor can be cooled before the air is expelled to atmosphere. Additionally, a post-motor filter (not shown) can be provided downstream of the motor and fan unit 50 in order to further minimise the risk of emissions into the atmosphere from the vacuum cleaner 10.

The entire cyclonic separator 52 is releasable from the chassis 12. A seal arm 90 is pivotally mounted about a pivot point 92 on the chassis 12. The seal arm 90 carries the inlet port 32 which, as described above, communicates with the cleaner head 22 by means of the rolling seal 30. The seal arm 90 is biased into an upward position (ie in an anticlockwise direction as seen in Figures 5a and 5b) by means of a compression spring 95 acting between a seat 94 of the seal arm 90 and a fixed part of the chassis 12 (not shown). The inlet port 32 carries a lip seal 33 located about the downstream mouth of the inlet port 32. When the cyclonic separator 52 is located in the position shown in Figure 5a, the inlet port 32 is pressed against the mouth of the tangential inlet 59 of the end portion 58 to form a seal therewith so that air can flow from the cleaner head 22 directly into the outer cyclone 54. A hooked catch 96 is provided on the seal arm 90 adjacent the inlet port 32 and on the side thereof remote from the motor and fan unit 50. The cyclonic separator 52 is held in position by means of the hooked catch 96 (in conjunction with the location of the vortex finder in the aperture in the end wall of the end portion) when the cleaner 10 is in use, as shown in Figure 5a. A button 34 located in the control panel 44 is connected by a rod (not shown) to a projection 97 on the seal arm 90 so that pressing the button 34 causes the seal arm 90 to move in a clockwise direction (as seen in Figure 5) against the bias of the spring 95. The inlet port 32 moves away from the mouth of the tangential inlet 59 so as to break the seal therewith. The hooked catch 92 is then released from the mouth of the tangential inlet 59 so that the cyclonic separator 52 can be lifted away from the chassis 12 by means of the gripper portions 70. Lifting the cyclonic separator 52 away from the chassis 12 after the seal 33 has been moved away from the tangential inlet 59 reduces wear on the seal and increases the life thereof. It also ensures that the seal is more effective and reliable because it operates under pressure even though it is not subject to the stresses which

would otherwise be imposed on a seal which connects two parts which are connected and released by way of a sliding movement. The bin 62 can subsequently be released from the end portion 58 (which carries with it the shroud 80 and the inner cyclone body 72) to facilitate the emptying thereof. When the cyclonic separator 52 is to be reconnected to the chassis 12, the cyclonic separator 52 is moved into the connected position in the direction of the arrow 99 (see Figure 5a). This movement brings the forward edge of the tangential inlet 59 into abutment with the hooked catch 96 which has an inclined side surface 96a. This arrangement causes the hooked catch 96 to be forced downwardly as the tangential inlet 59 moves into the correct position. When the tangential inlet 59 is in the correct position, the hooked catch 96 is urged upwardly into the operative position shown in Figure 5a so that the cyclonic separator 52 is again held in position on the chassis 12. Again, during the relative movement between the two parts, ie the chassis 12 and the cyclonic separator 52, the seal 33 is out of contact with the tangential inlet 59 so that no unnecessary wear is applied to the seal 33.

When the bin 62 is released from the end portion 58, the user has the option to replace the two parts together in a different configuration. Instead of locating the end portion 58 on the bin 62 so that the tangential inlet 59 extends downwardly towards the inlet port 32, the end portion 58 can be turned through 180° so that the tangential inlet 59 extends vertically upwardly. The two positions of the end portion 58 with respect to the bin 62 are diametrically opposed. Shapings (not shown) can be moulded into the bin 62 and end portion 58 in order to avoid the relevant parts being joined together in other configurations. The execution of the rotation of the end portion 58 with respect to the bin 62 is easily carried out by first separating the two parts, re-orienting them and then joining them in the appropriate manner.

When the end portion 58 has been rotated with respect to the bin 62 as described above, the tangential inlet 59 will then extend vertically upwardly. This exposes the tangential inlet 59 as shown in Figure 4b so that a hose or a hose and wand assembly can be attached directly to the tangential inlet 59. The hose 100 has a connector 102 which comprises a tubular conduit 104 which is dimensioned so as to fit snugly inside the

tangential inlet 59, and a flange 106 which extends outwardly from the conduit 104. The flange 106 carries a seal 107 which, when the connector 102 is introduced to the tangential inlet 59, abuts against the mouth of the tangential inlet 59. When the hose 100 is fitted to the tangential inlet 59, the operation of the motor and fan unit 50 draws air into the cleaner 10 via the hose 100 instead of via the cleaner head 22. The hose or hose and wand assembly can then be used to clean areas of the carpet or other surface to be cleaned which cannot be reached by the cleaner when it is operating in a robotic mode; for example, when small or narrow areas need to be accessed.

The vacuum cleaner 10 described above operates in the following manner in a robotic mode. In order for the cleaner 10 to traverse the area to be cleaned, the wheels 14 are driven by the motors 15 which, in turn, are powered by the batteries 46. The direction of movement of the cleaner 10 is determined by the control software which communicates with the sensors 40 which are designed to detect any obstacles in the path of the cleaner 10 so as to navigate the cleaner 10 around the area to be cleaned. Methodologies and control systems for navigating a robotic vacuum cleaner around a room or other area are well documented elsewhere and do not form part of the inventive concept of this invention. Any of the known methodologies or systems could be implemented here to provide a suitable navigation system.

The batteries 46 also provide power to operate the motor and fan unit 50 to draw air into the cleaner 10 via the suction opening 24 in the cleaner head 22. The end portion 58 is orientated so that the tangential inlet 59 to the outer cyclone 56 communicates with the cleaner head 22. The motor 28 is also driven by the batteries 46 so that the brush bar 26 is rotated in order to achieve good pick-up, particularly when the cleaner 10 is to be used to clean a carpet. The dirty air is drawn into the cleaner head 22 and conducted to the cyclonic separator 52 via the telescopic conduit 30 and the inlet port 32. The dirty air then enters the entry portion 58 in a tangential manner and adopts a helical path by virtue of the shape of the helical wall 60. The air then spirals down the interior of the outer wall 64 of the bin 62 during which motion any relatively large dirt and fluff particles are separated from the airflow. The separated dirt and fluff particles collect in

the end of the bin 62 remote from the entry portion 58. The fin 78 discourages uneven accumulation of dirt and fluff particles and helps to distribute the dirt and fluff collected around the end of the bin 62 in a relatively even manner.

The airflow from which dirt and larger fluff particles has been separated moves inwardly away from the outer wall 64 of the bin 62 and travels back along the exterior wall of the fine dust collector 74 towards the shroud 80. The presence of the shroud 80 also helps to prevent larger particles and fluff traveling from the outer cyclone 54 into the inner cyclone 56, as is known. The air from which comparatively large particles and dirt has been separated then passes through the shroud 80 and travels along the channel between the shroud 80 and the outer surface of the inner cyclone body 72 until it reaches the inlet port 86 to the inner cyclone 56. The air then enters the inner cyclone 56 in a helical manner and follows a spiral path around the inner surface of the cyclone body 72. Because of the frusto-conical shape of the cyclone body 72, the speed of the airflow increases to very high values at which the fine dirt and dust still entrained within the airflow is separated therefrom. The fine dirt and dust separated in the inner cyclone 56 is collected in the fine dust collector 74 outwardly of the dust ring 68. The dust ring 68 discourages re-entrainment of the separated dirt and dust back into the airflow.

When the fine dirt and dust has been separated from the airflow, the cleaned air exits the cyclonic separator via the vortex finder (not shown). The air is passed over or around the motor and fan unit 50 in order to cool the motor before it is expelled into the atmosphere. When a hose or hose and wand assembly is to be used to clean other areas, the cyclonic separator 52 is released from the chassis 12 and the end portion 58 is moved to the orientation in which the tangential inlet 59 is exposed so that the hose 100 can be attached. The cyclonic separator is then replaced on the chassis 12 and the hose is attached to the inlet 59. The motor and fan unit 50 is then switched on and cleaning recommences. The cyclonic separator 52 is also released from the chassis 12 when the bin 62 requires to be emptied.

The invention is not intended to be limited to the precise details of the embodiment described above. Most importantly, the invention is not to be regarded as applicable only to vacuum cleaners or to vacuum cleaners with cyclonic separators or which are robotic in nature, although the specific example described above indicates that the invention has application in these areas. The invention has application in any area in which a first part and a second part are required to be releasable from one another frequently and without the application of special skills or expertise. It will be appreciated that, although the specific example given above is of a vacuum cleaner, the invention can form part of any device in which a fluid flow is carried between two points. Specifically, it will be appreciated that the conduits can be adapted or intended to carry any fluid such as gases other than air or liquids such as water.

Claims:

1. A connector for forming a connection between a first part and a second part releasable from the first part, the first and second parts having conduits arranged therein, which conduits are arranged to communicate with one another when the first part is connected to the second part, and having a seal arranged between the first and second parts, characterised in that the connector comprises a movable arm mounted on the first part and carrying a portion of the first part defining the respective conduit, and biasing means biasing the said portion of the first part towards the second part.

2. A connector as claimed in claim 1, wherein the direction in which the second part is releasable from the first part is substantially perpendicular to the direction of movement of the said portion of the first part.

3. A connector as claimed in claim 1 or 2, wherein the seal is located on the said portion of the first part.

4. A connector as claimed in any one of claims 1 to 3, wherein the seal is a lip seal.

5. A connector as claimed in any one of the preceding claims, wherein the conduits are generallycircular or D-shaped in cross-section.

6. A connector as claimed in any one of the preceding claims, wherein the biasing means act between a seat of the movable arm and a fixed portion of the first part.

7. A connector as claimed in any one of the preceding claims, wherein the biasing means comprise a spring.

8. A connector as claimed in claim 7, wherein the biasing means comprise a compression spring.

9. A connector as claimed in any one of the preceding claims, wherein the movable arm carries a hooked catch for engagement with the second part.

10. A connector as claimed in claim 9, wherein the hooked catch is carried by the portion of the first part defining the respective conduit.

11. A connector as claimed in claim 9 or 10, wherein the hooked catch has an inclined side surface on one side thereof.

12. A connector as claimed in any one of the preceding claims, wherein the movable arm is pivotably mounted on the first part.

13. A connector as claimed in any one of the preceding claims, wherein the first part comprises a chassis or housing of a vacuum cleaner.

14. A connector as claimed in claim 13, wherein the second part comprises the inlet to dirt and dust separating apparatus.

15. A connector as claimed in claim 14, wherein the dirt and dust separating apparatus comprises cyclonic separating apparatus.

16. A connector as claimed in claim 15, wherein the cyclonic separating apparatus comprises two cyclones arranged in series.

17. A connector for forming a connection between a first part and a second part releasable from the first part substantially as hereinbefore described with reference to the accompanying drawings.

18. A vacuum cleaner incorporating a connector as claimed in any one of the preceding claims.

19. A vacuum cleaner as claimed in claim 18, further comprising means for moving the movable arm so that the said portion of the first part is moved away from the second part.

20. A vacuum cleaner substantially as hereinbefore described with reference to the accompanying drawings.

The Patent Office

INVESTOR IN PEOPLE

Application No: GB 9827776.7 **Examiner:** Roger Binding
Claims searched: 1-20 **Date of search:** 8 March 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): F2G (G4A, G4B1, G4B2, G4C, G4F, G4Z)

Int Cl (Ed.6): F16L 37/00, 37/08, 37/084, 37/12, 37/133, 37/26, 37/50, 37/58; A47L 9/00

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2115509 A	(C VAN DER LELY), see Figs 5, 6 and page 4, line 68, to page 5, line 61.	1, 3-7, 12
X	GB 0425783 A	(SKODA)	1, 3, 5-7, 12

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.